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ALBERTANS & CLIMATE CHANGE

A Plan for Action

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Albertans & Climate Change

A Plan for Action

Executive Summary

Introduction

Albertans recognize and strongly agree that climate change is a growing concern to all Canadians, and action must be taken to address the issue.

We are committed to doing our part to manage the risks of climate change by thinking globally, and acting locally through a combination of actions we can take today, and actions aimed at changing behaviours and environmental practices from generation to generation.

Alberta is recommending an approach that makes sense, is cost effective and that achieves meaningful, long-term emissions reductions and lasting behavioural change. In other words, an approach that contributes to international climate change objectives to reduce greenhouse gas emissions, while at the same time enhancing both Alberta's and Canada's competitiveness by capitalizing on new economic and environmental opportunities.

This "made-in-Alberta" approach to climate change involves a number of actions and ideas aimed at reducing emissions, investing in research and technology, conserving energy, providing leadership and adapting to change.

> *The Alberta Government's climate change response will demonstrate there is a way to reconcile real and lasting emissions reductions with continued economic prosperity.*
>
> **Premier Ralph Klein**

Background

In February 2002, the Government of Alberta released its climate change strategy, *Albertans & Climate Change: A Strategy for Managing Environmental and Economic Risks*, outlining its position on taking action on climate change.

Albertans & Climate Change: A Plan for Action provides details on the goals, timelines and actions Albertans can take to address the possible effects of climate change. It is designed to provide a practical alternative to the Kyoto Protocol. In parallel with the federal plan and through consultation with Albertans, the Alberta plan will:

- Be a meaningful alternative to Kyoto, focused on a technologically driven solution, rather a politically driven one.
- Take immediate actions to address climate change.
- Set a more realistic, and longer time frame to reflect technology lead times and expected capital stock turnover.
- Keep capital in Alberta and Canada to invest in technology, research and development, rather than spending it primarily on international Kyoto emissions permits.

Draft for Discussion

ALBERTANS & CLIMATE CHANGE

- Exercise Alberta responsibility to address climate change as an environmental and natural resource related issue.

Core Principles

Alberta's proposed plan for action is designed to achieve environmental benefits while addressing economic risks and realities for Alberta consumers, business and industry based on the following core principles:

- Informed consultation with key stakeholders and the public in the development and implementation of a climate change action plan is vital if we are going to make a meaningful and real difference.
- Actions we develop must be compatible with our largest trading partner - the U.S. - in order to ensure we maintain our competitiveness.
- Immediate investment in new energy, emissions and environmental technologies is the key to environmental improvements that will also reap economic benefits.
- On-going investment in technology and energy research is the key to breaking the direct link between emissions and economic development.
- As energy consumption drives emissions, energy conservation and efficiency must be a core part of our climate change response.
- Alberta will continue to work with the other provinces and territories to develop a national plan for action that is in Canada's best environmental and economic interests.
- All Albertans must be part of the provincial climate change solution.

Taking Action

Following up on those goals and principles, the "made-in-Alberta" approach to climate change involves a number of actions and ideas aimed at reducing emissions, providing leadership, investing in research and technology, conserving energy, and adapting to change.

Specific actions and activities include:

Emissions Reductions:

- In consultation and cooperation with all Albertans, reduce greenhouse gas emissions intensity, or emissions relative to GDP, by 50 per cent by the year 2020. For Alberta-based consumption, this will work out to about the equivalent of 10 per cent below 1990 emission levels.
- Work to be "best-in-class" in both reducing emissions intensity of energy exports, and emissions from Alberta-based industrial and consumer activity.
- Work to fulfill the goal of the United Nations Framework Convention on Climate Change - preventing atmospheric concentrations of greenhouse gases from reaching dangerous levels - by moving towards more significant emissions reductions over the longer term to 2050.

Government Leadership:

Province-wide Initiatives:

- Implement a mandatory greenhouse gas emissions reporting program for large emission sources.
- Facilitate and negotiate agreements with specific economic sectors, including electricity, oil and gas, transportation, forestry, municipalities and other industries to gain commitment for action for reducing greenhouse gas emissions.
- Lead the development of an approach to emissions trading that reflects Alberta's unique needs and circumstances, complements the negotiated sectoral agreements, and works with national, continental and international systems.

Government Action:

- Reduce emissions related to government activities and facilities by 26 per cent by 2005.
- Support programs for energy retrofits in government facilities.
- Purchase hybrid vehicles for the government fleet.
- Move to the use of more green power for government facilities.
- Establish an "innovation fund" for leadership in reducing emissions within government.

Technology and Innovation:

- Through the Alberta Energy Research Institute's (AERI) Energy Research Strategy, support and encourage the development of new technologies that emphasize environmental performance in the discovery, recovery, processing, support and transport of Alberta's energy resources.
- Implement a provincial fuel cell strategy through demonstration projects.
- Invest in a hydrocarbon research program (support the Canadian Clean Power Coalition and National Science and Energy Research Council (NSERC) Chair in Coal Combustion).
- Support specific key programs for technology development in environment management and greenhouse gas emissions control and reduction.

Carbon Management:

- Implement a carbon management program that will demonstrate that the $C0_2$ by-product of fossil fuel production can be stored in geologic formations similar to those from which the fossil fuels were originally extracted.
- Conduct three demonstration projects (Enhanced Oil Recovery and Coal Bed Methane) by end of 2003.
- Continue support for $C0_2$ storage demonstration project at Weyburn, Sask.

Energy Conservation:

- Support Climate Change Central in establishing an Alberta Office for Energy Efficiency.
- Develop and implement a municipal building energy audit program.

- Establish a provincial task force to look at market signals and opportunities to encourage energy conservation activities.
- Implement a province-wide energy conservation education and awareness campaign.
- Support public education and recognition programs aimed at promoting and rewarding energy conservation practices.

Agricultural and Forestry Carbon Sinks:

- Explore opportunities to encourage the removal of $C0_2$ from the atmosphere through the use of forestry and agricultural sinks.
- Develop provincial accounting rules and guidelines for crediting carbon storage projects.
- Clarify ownership rules around credits and enhancement for carbon sinks.
- Support and invest in programs aimed at measuring natural storage of carbon.

Adapting to Climate Change:

- Develop a provincial strategy for adapting to the effects of climate change.
- Support and invest in climate change adaptation research.

Next Steps

Overall, *Albertans & Climate Change: A Plan for Action* outlines positions, approaches and opportunities to make a real difference in managing the environmental and economic impacts of climate change.

This action plan can serve as the basis for an effective, collaborative, equitable national approach to climate change, which respects the goals and values of Albertans - enjoying prosperity and opportunity in an enhanced Alberta environment - while contributing responsibly to solve global issues.

In consultation and collaboration with all Albertans, work will now begin on implementing the specific actions to achieve our climate change objectives - reducing emissions and preventing concentrations of greenhouse gases in the atmosphere from reaching dangerous levels, while enhancing our international competitiveness.

A Plan for Action

Introduction

Alberta is committed to managing the environmental and economic risks of climate change. Albertans - public and private sector together - are recognized as leaders in responding to climate change. Many of our companies, associations, governments and individuals have won national awards. Climate Change Central - our multi-stakeholder private-public partnership - is recognized as an innovator in developing and demonstrating responses to climate change.

In February 2002, the Alberta government released a statement of Alberta's climate change strategy *Albertans & Climate Change: A Strategy for Managing Environmental and Economic Risks*. This draft of Alberta's Plan for Action takes the strategy to the next stage, by specifying goals, establishing a framework for action, outlining potential actions and commitments, and identifying opportunities for consultation with stakeholders and Albertans.

Background

In February 2002, the Government of Alberta released its climate change strategy, *Albertans & Climate Change: A Strategy for Managing Environmental and Economic Risks*, outlining its position on taking action on climate change.

Albertans & Climate Change: A Plan for Action provides details on the goals, timelines and actions Albertans can take to address the possible effects of climate change. It is designed to provide a practical alternative to the Kyoto Protocol. In parallel with the federal plan and through consultation with Albertans, the Alberta plan will:

- Be a meaningful alternative to Kyoto, focused on a technologically driven solution, rather a politically driven one.
- Take immediate action on climate change.
- Set a more realistic, and longer time frame to reflect technology lead times and expected capital stock turnover.
- Keep capital in Alberta and Canada to invest in technology, research and development, rather than spending it primarily on international Kyoto emission permits.
- Exercise Alberta's responsibility to address climate change as an environmental and natural resource related issue.

Core Principles

In February 2002, the Alberta government outlined the following principles to guide the development of our climate change approach:

- Informed consultation with key stakeholders and the public in the development and implementation of a climate change action plan is vital if we are going to make a meaningful and real difference.
- Any actions we develop must be compatible with our largest trading partner - the U.S. - in order to ensure we maintain a competitive economic advantage.
- Immediate investment in emissions control technology is the key to environmental improvements that will also reap economic benefits.
- On-going investment in technology and energy research is the key to breaking the direct link between emissions and economic development.
- As energy consumption drives emissions, energy conservation and efficiency must be a core part of our climate change response.
- Alberta will continue to work with other provinces and territories to develop a national plan for action that is in Canada's best environmental and economic interests.
- All Albertans must be part of the provincial climate change solution.

Taking Action

Strategies require clear goals to guide action. Responding to climate change is no different.

Our targets and goals must clearly lead to the desired long-term objectives. Focusing on arbitrary, internationally-imposed, short-term targets that are unrealistic and costly for Canada risks diverting resources and attention away from the most effective investment decisions (e.g. supporting new energy production technologies and methods of capturing and storing carbon dioxide).

For too long, Canadian discussion of targets has been shaped by the Kyoto targets imposed internationally without analysis and with the expectation - which has not borne out - that our largest trading partner and neighbour, the United States, would accept a similar target.

The timeframe for the Kyoto target (2008-2012) allows little time for technological change and capital stock turnover.

Our strategy addresses Alberta's long-term technological opportunities and the role that all energy consumers have in reducing greenhouse gas emissions.

Alberta will contribute to a global response through our expertise in developing and demonstrating leading-edge technologies and practices for producing and delivering energy with low associated emissions. Proactive provincial action will position Alberta to compete in an emissions-constrained future, and to help the world meet its energy requirements, with sharply reduced emissions.

Alberta's plan calls for actions in the following areas:

- Emissions Reductions
- Government Leadership
- Energy Conservation
- Carbon Management
- Technology and Innovation
- Enhancing Carbon Sinks
- Adaptation

Vision

In consultation and cooperation with all Albertans, reduce greenhouse gas emissions intensity, or emissions relative to GDP, by 50 per cent by the year 2020. For Alberta-based consumption, this will work out to about the equivalent of 10 per cent below 1990 emission levels.

It is time to adopt a reasonable objective - a benchmark for our strategy and action - that is based on Alberta's economic reality.

This is a target that is useful to us in managing our progress on real greenhouse gas emissions reductions, and not a mechanism that is simply aimed at transferring revenue to other parts of the world.

Alberta's Emissions Target

The Alberta government is committed to the outcome of the United Nations Framework Convention on Climate Change - preventing atmospheric concentrations of greenhouse gases from reaching dangerous levels.

In pursuit of that outcome, Alberta recognizes that more significant emissions reductions will be required over the longer term (2050) in order to meet the goal of the Framework Convention.

Therefore, in consultation and cooperation with all Albertans, reduce greenhouse gas emissions intensity, or emissions relative to GDP, by 50 per cent by the year 2020. For Alberta-based consumption, this will work out to about the equivalent of 10 per cent below 1990 emission levels.

The Government of Alberta will also:

- Work to be "best-in-class" in both reducing emissions intensity of energy exports, and emissions from Alberta-based industrial and consumer activity.
- Work to fulfill the goal of the United Nations Framework Convention on Climate Change - preventing atmospheric concentrations of greenhouse gases from reaching dangerous levels - by moving towards more significant emission reductions over the longer term to 2050.

The federal government has taken the position that a jurisdiction that produces energy exports should not be liable for these production-related emissions, when this energy contributes to a reduction in global greenhouse gas emissions.

In a world where only some jurisdictions are forced to bear the costs of emissions reductions, constraints on Canadian energy production that competes internationally would simply displace investment, jobs and revenue to those jurisdictions without greenhouse gas limitations - with no environmental benefit and perhaps even greater environmental risks (from more emissions-intensive production and transportation).

Moreover, the United States, the major and growing market for our energy services, has adopted a strategy of reducing the emissions-intensity of energy development. Responding to the climate change challenge requires an aggressive, yet realistic approach.

Draft for Discussion

Emissions intensity is constantly improving. A 50 per cent reduction in greenhouse gas emissions intensity is a goal that will require investment in developing new technologies and innovations in putting new technologies and practices into operation.

The emissions intensity target truly focuses on our objective - reducing emissions while maintaining our economic prosperity. The year 2020 provides the opportunity to see the early impact of technological development around clean coal production, carbon capture and storage and other efficiencies of energy production, transportation and use.

The reduction in emissions intensity should translate into an absolute reduction in emissions.

While exact results will depend on the rate of economic growth and the rate of implementation of technology, the intensity target could translate into about 10 per cent below 1990 emission levels by 2020.

This is a tough but realistic objective.

Achieving the target will require action across the Alberta economy - in all areas that consume energy - and in areas that can potentially sequester or capture and store emissions.

This will require:

- Increased energy efficiency across the economy.
- Sector-specific emission reduction strategies developed through transparent processes (such as the Clean Air Strategic Alliance process for the electricity sector) that:
  - Include greenhouse gas emission targets (e.g. intensity targets such as greenhouse gas emissions per kilowatt hour of generation).
  - Ensure meaningful results by using management tools such as sectoral agreements, reporting of results and regulatory requirements.
  - Consider the use of emission trading systems to provide additional flexibility and help minimize the costs of achieving targets.

"Best in Class" Clean Energy Exports

Alberta is proposing to measure it's domestic emissions, and is also obligated to ensure that Alberta's energy services are as clean or cleaner than their international competition.

Over the past decade, Alberta's petroleum sector has made significant improvements in its efficiency and in the emissions associated with the production of various commodities (e.g. oil sands, bitumen, natural gas). These gains have been achieved through the introduction of new innovative technologies and practices within this sector.

The Alberta government wants to build on these improvements and work with industry to accelerate industry take-up of best practices. Similar to other sectors of the economy, the Alberta government will establish a framework that assures "best in class" production of energy, regardless of the ultimate destination of these products.

Vision

Alberta organizations and the public will have a clear understanding of the role they can play and the tools they can utilize to contribute to Alberta's objective of reduced carbon intensity. In providing leadership to others, the Alberta government will adopt leading-edge energy efficient practices and technologies that significantly reduce the environmental footprint of government operations.

The role of the government overall in addressing climate change is to be a leader, a partner, a facilitator and an innovator. It is government's role to educate, motivate, inspire and ensure action is being taken.

The Government of Alberta has been addressing climate change since 1990 by seeking to influence national policy and by taking action to reduce greenhouse gases in Alberta.

We are acknowledged as a national leader in this area, both through our early actions to date, and by the fact that the Alberta government is the only government in Canada to win a national leadership award - three times to date - for voluntarily reducing greenhouse gas emissions.

In 1995, the government said it would reduce greenhouse gas emissions from its operations by 14.1 per cent below 1990 emission levels. By end of 2000, the government had exceeded this target, reducing emissions by 22 per cent.

As well, in 1999 the Government of Alberta formally established Climate Change Central, a unique private-public partnership non-profit organization, to follow up and implement key directions and recommendations of an Alberta climate change round table held earlier that year.

Climate change is not just a government issue. It is not just an industry issue. Consumption is the key driver behind emissions - so it is an issue for every one of us.

As a result all Albertans must work together if we are really going to make a difference.

The Government of Alberta is committed to leading action on climate change on key province-wide actions and initiatives, and to taking action immediately and where possible within government itself.

ACTION:

Facilitate and negotiate agreements with specific economic sectors, including electricity, oil and gas, transportation, forestry, municipalities and other industries to gain commitment for action for reducing greenhouse gas emissions.

Alberta organizations - industry, municipalities, consumer organizations - are looking for an overall framework under which they can take actions to reduce greenhouse gas emissions and reduce economic and environmental risks. Successfully establishing this overall framework requires strong partnerships. The Alberta government will enter into discussions and negotiations with major sectors of Alberta society to determine what each sector - and the government - will bring to each agreement.

These partnerships will take on slightly different characteristics, depending on the nature of the sector. For example, some agreements may focus on achieving emissions intensity improvements, absolute emission reductions, or periodic "step" changes that reflect capital stock turnover and new technology development. Other partnership agreements may focus on the establishment of sector-wide benchmarks that will drive continuous improvement. Other sectoral approaches may focus on how to facilitate investment in energy efficiency and conservation.

The Alberta government is already pursuing a sectoral approach through its partnership in Alberta's Clean Air Strategic Alliance (CASA), which is currently working to develop a broader air emissions management approach for the electricity sector, including performance expectations for greenhouse gas emissions.

With respect to the petroleum sector, the Alberta government will build on recent trends and achieve a continued reduction in the emissions per unit of production for each major petroleum commodity. An agreement with the petroleum sector will reflect the realities of the Alberta industry in terms of capital stock, the nature of Alberta's energy resources, technological change, industry best practices, and the desire for a level playing field both internationally and with U.S.-based industry. Areas for further investigation with industry include: upstream energy efficiency initiatives and possible rationalization of gas plants in Alberta. In addition, government-industry collaboration on technological development and carbon capture and storage provides both a driver for industry improvement, and the opportunity for step changes in emissions.

Sectoral agreements would build on existing initiatives, such as the work of CASA in developing a framework for reducing flaring within the petroleum sector. Under this approach, the government made a clear policy statement that flaring had to be reduced. A workable framework for reducing and managing flaring was developed, including performance standards that could be met through voluntary actions but were "backstopped" by clear government statements regarding the consequences of not achieving the sector-wide objectives. Through this broad sectoral approach, this sector has been able to reduce flaring of oilfield gases by 50 per cent in the past year - well ahead of projected targets.

In addition to the Alberta electricity and petroleum sectors, partnership agreements will be sought with a broader range of sectors that may include: agriculture, construction sector, municipal sector, forestry, oil and gas, petrochemicals and trucking.

ACTION:

Implement a mandatory greenhouse gas emissions reporting program for large emission sources.

The Alberta government will also require reporting of greenhouse gas emissions by large sources in Alberta, allowing the province to develop a stronger understanding of the nature of its greenhouse gas emissions sources. Greenhouse gas reporting will also help industry better manage its own emissions.

ACTION:

Lead the development of an approach to emissions trading that reflects Alberta's unique needs and circumstances, complements the negotiated sectoral agreements, and works with national, continental and international systems.

Once performance expectations are established for key sectors of the province, it is important that companies have the opportunity to pursue innovative means of meeting these expectations.

In *Albertans & Climate Change: A Strategy for Managing Environmental and Economic Risks*, the Government of Alberta states it will advance a domestic emissions trading system that would provide such flexibility yet allow the province to retain the ability to set overall greenhouse gas emission reduction objectives and plug into national, continental and international trading systems.

The Alberta government has already begun to establish a foundation on which an emissions trading system can be developed. Alberta has provided the stimulus for emissions offset trading by requiring that recently approved thermal (coal-fired) generation must offset greenhouse gas emissions down to the level equivalent of a combined cycle natural gas turbine. This represents a 60 percent reduction in net greenhouse gas emissions from these facilities.

Building on this initial direction:

- Alberta is well positioned to move forward as a leader in establishing the mechanisms for facilitating emissions trading. Alberta can build on its experience in developing energy markets and defining commodities that can ultimately be traded on the open market.
- Alberta will determine the reduction commitments of Alberta sectors through sectoral agreements. Part of these negotiations will include the scope through which sectors will be able to pursue emission reductions. In advance of sectoral consultations, the Alberta government is taking action to facilitate participation in emissions trading systems.

For example:

- Alberta will develop an Emission Reduction Registry, which will ensure registered emission reductions have clear and unique title and can form the basis for transparent verification protocols.
- Alberta will establish rules within the next six months determining eligibility for emission credits to meet the offset requirement. In doing so, Alberta will consult on:
  - Linking our approach to a continental trading system (possibly linked to NAFTA) that allows for U.S.-based credits.
  - The role that private sector investments in technology research and development can play in meeting performance expectations.
  - The range of activities and initiatives from within the province that would be eligible for credit creation (e.g. role of telecommuting initiatives).

- The viability of developing a joint industry/government mutual "carbon fund" approach to purchase international offsets/credits and advance Alberta economic and technology transfer opportunities.

Ultimately, the effectiveness of an emissions trading system depends upon the breadth and scope of the system being used.

The Alberta government will seek to ensure the broadest possible framework for emissions trading, thereby ensuring a robust and effective market that lowers the cost of achieving any specific reduction. At the same time, Alberta's approach to emissions trading will not be based on the generation of revenues that governments would ultimately have to redistribute throughout the economy.

The Alberta government will also continue to work with other governments in Canada to ensure there is a consistent commodity that can be traded across Canada, and possibly within North America and internationally.

ACTION:

Lead by example through action within the Government of Alberta.

The Alberta government has led by example and reduced emissions from its own operations. Cost effective actions taken in government buildings and fleets since 1995 have resulted in a 22 per cent reduction in greenhouse gases below 1990 levels.

This achievement exceeded the 14.1 per cent reduction target for government operations that was established in 1995.

A new target of a 26 per cent reduction below 1990 levels by 2005 has been established.

The Alberta government can continue to set an example for others by demonstrating a range of cost-effective actions. Just as the province is seeking agreements with other sectors, it will also enter into an agreement with Albertans regarding its own commitment to reduce emissions from its own operations.

In its efforts to continue to highlight the range of opportunities available to others, the Alberta government will consider actions that include the following:

- Reduce emissions related to government activities and facilities by 2005.
- Support programs for energy retrofits in government facilities.
- Purchase hybrid vehicles for the government fleet.
- Move to the use of more green power for government facilities.
- Establish an "innovation fund" for leadership in reducing emissions within government.

Technology and Innovation

Vision

Alberta is recognized around the globe for leading-edge innovation in environmentally sustainable energy development, transportation and value-added use that maximizes the value of its energy resources and the prosperity of its citizens.

The Government of Alberta is supporting strategic research related to energy research and development that reduces the costs and environmental footprint associated with energy production, distribution and use in Alberta.

Through our strategic investments, the aim is to make the province a world-class energy research centre.

Alberta's investment in greenhouse gas reducing technologies will be coordinated through the Alberta Energy Research Institute (AERI).

AERI's mandate is to promote energy research, technology evaluation and technology transfer in areas that include oil and gas, heavy oil and oil sands, coal, electricity, renewable and alternative energy. AERI advises the Minister of Innovation and Science and the government regarding energy research and the development of resources in the interest of Albertans.

AERI's strategic intent is to stimulate R&D of new technology and assist the energy sector to play a dominant role in the new economy by:

- Developing value-added products and processes including alternate and renewable energy sources.
- Promoting environmental sustainability.
- Reducing the costs of development and increasing reserves.

AERI will achieve its mandate by promoting collaborative research conducted by the private sector, government labs and universities.

AERI will take a long-term view, ensuring that the knowledge required to maximize the value of Canada's resources and minimize the environmental impact continues to grow by catalyzing and stimulating the research and development of new technology.

Alberta's integrated and comprehensive Energy Research Strategy will play a key role in transforming separate sectors (oil and gas, coal, power and petrochemical) of the economy into an integrated energy industry focused on the utilization of Alberta's resources to their fullest potential.

The emphasis will be on managing carbon, hydrogen and nitrogen to achieve the highest value-added energy products and best-in-class environmental standards.

The three initial primary strategic drivers for research and technology will be:

- Development of cleaner coal technologies for electricity generation. In addition, the use of coal and other feedstocks for production of steam, hydrogen (for oil sands upgrading and fuel cells) and the capture of concentrated CO_2 streams for enhanced oil and gas recovery.
- Oil sands upgrading technology for a new product standard of quality customized to North American refineries. This will allow Alberta to reduce environmental impacts, and maintain/enhance the value obtained from bitumen and synthetic production, which is expected to double in the next five years.
- Management of CO_2 and other emissions by developing technology that will capture, transport and utilize the CO_2 for increasing recovery of conventional crude oil and injection into coal beds to release natural gas.

In addition to these major thrusts, the strategy includes research issues related to:

- Unlocking the potential of coal bed methane.
- Renewable and alternative energy associated primarily with fuel cell development and hydrogen technology.
- Lower intensity oil sands production and upgrading.
- Locating and enhancing recovery of conventional oil and gas.
- Environmental and climate change aspects of oil, gas and coal production and use.

Our investments will lead to field plant demonstrations of value-added upgrading of Alberta resources into energy services (e.g. electricity, hydrogen, biofuels) and feedstocks with a significant reduction in greenhouse gas emissions intensity.

Specific areas of focus and related actions will include:

Cleaner Energy

- Develop a network linking provincial, national and global research activities in cleaner energy.
- Leverage funds from the federal government, industry and research funding sources into a cleaner energy research program.
- Promote bench scale and pilot projects in clean coal technologies, integration with other feedstocks and low intensity heavy oil upgrading, and in emissions sensing and mitigation.

Upgrading Technologies

- Conduct a technical audit of research programs to understand the benefits and help re-position upgrading research areas that involve less energy intensity and customized synthetic products.

Improved Oil and Gas Production

- Work with other research agencies on less energy intensive in-situ and extraction processes, water usage and tailings management issues.
- Work with research organizations and industry associations to promote industry consortia and working groups with a focus on oil and gas enhanced technology and optimizing economics.
- Work with Climate Change Central, the Petroleum Technology Alliance of Canada (PTAC) and the Canadian Environmental Technology Advancement Corporation (CETAC-West) to support emerging greenhouse gas (GHG) technologies.

Fuel Cells and Hydrogen

- Develop and implement an Integrated Energy Research Strategy for Alberta as a component of the Integrated Energy Research Strategy.
- Increase the portfolio of renewable energy projects, including areas such as fuel cells and hydrogen technology.
- Interact with renewable and alternative energy industries and associations to establish their research priorities and assist research providers to address these priorities.

Vision

Alberta develops the capacity for cost-effective and safe capture, use and storage of carbon dioxide (CO_2) for enhanced resource recovery and to reduce the risk of greenhouse gas constraints in the expansion of Alberta's resource sector.

Carbon management is the storage of carbon dioxide (CO_2) in geological formations.

Alberta CO_2 (e.g. from oil sands upgrading, oil refining, power generation and petrochemical production) could potentially be captured and used to increase production from oil and coalbed methane reservoirs or be stored.

Currently, market conditions do not encourage widespread commercial use of CO_2 in Enhanced Oil Recovery (EOR), or enhanced coal bed methane (ECBM) or other applications.

The economics of capturing a pure stream of CO_2 are, at present, marginal. However, with higher than historic oil and natural gas prices, there is industry interest in exploring options for enhanced oil and gas recovery using captured CO_2.

Industry is reluctant to move forward to establish the necessary facilities (e.g. CO_2 capture equipment, pipeline infrastructure) until they are provided with longer-term certainty around the economic and resource conservation benefits of using CO_2. Because industry feels there is a risk associated with developing a CO_2 market, it says governments should provide favourable royalty terms and jointly invest in research, technology development and capital (e.g. pipeline infrastructure).

The proposed carbon management strategy consists of eight broad goals.

Each area will be addressed over a planning phase of eight years, which has been divided in three phases:

Phase 1: Current - 2003 — Enhanced recovery of Alberta fossil fuel resources.

Phase 2: 2004 - 2007 — Building the CO_2 market in Alberta.

Phase 3: 2007 - 2010 — Commercially testing zero-emission coal plants.

The eight goals are:

Developing the CO_2 EOR Market

- By 2003, the Alberta government will partner with industry on three commercial projects to use carbon dioxide to enhance oil production or maintain reservoir pressure.

Development of Alberta's Geo-science Base for CO_2 Storage in Geological Media

- The Alberta Geological Survey, in partnership with the Geological Survey of Canada will expand and support activities in the analysis of Alberta's subsurface suitability, capacity and safety for CO_2 sequestration in hydrocarbon reservoirs, coal beds, and deep saline formations (location, capacity, and characteristics for various CO_2 storage options).

- The Alberta Geological Survey and Geological Survey of Canada, Alberta Research Council, Natural Resources Canada, Alberta universities, consortia and industry will work in partnership to assess the integrity and safety of such locations, both in the short and long term.

Cutting the Costs of Capture

- Considerable global research effort is underway to reduce the costs of purifying and capturing carbon dioxide from plant stacks. Drawing upon these efforts, research, adaptation and demonstration of new capture technologies will be a primary part of the proposed new focus on energy research in Alberta.
- As part of the Alberta Energy Research Institute's Energy Strategy, initiatives will be pursued with a goal of reducing the cost of capture and compression of CO_2 by 50 percent for retrofit operations and a fourfold reduction in costs associated with new facilities.

Finding New Resources - Coal Bed Methane

- The Alberta Geological Survey and the Alberta Research Council will expand efforts in mapping and characterizing coal beds and developing a better understanding of Alberta's coal bed methane potential. They will identify which coal beds are appropriate for enhanced methane production by CO_2 injection and storage, and address issues related to the disposal of produced water.
- Partnerships will be pursued with industry players that are already engaged in research efforts, and also to bring in new players. A key component will be to proceed with technical demonstration projects for Enhanced Coal Bed Methane Recovery.

Infrastructure Development

- Identify infrastructure needs (e.g. pipelines or other facilities required for CO_2 transmission to selected sites) and assess the merits of building the infrastructure through incremental efforts under an industry consortium, or of allowing for sole ownership if a company expresses interest in building a CO_2 infrastructure.
- Recommend how to proceed with infrastructure development (e.g. mega-project vs. project by project investments).

Develop Economic, Fiscal and Regulatory Requirements

- Work in collaboration with government agencies (including the federal government), industry, and Climate Change Central to identify the types of economic, fiscal and regulatory frameworks that are conducive to a Carbon Management Strategy.

Clarify Environmental/Health and Monitoring Requirements

- Focus research on the short and long-term fate and safety of geologically stored CO_2 to increase confidence and reduce risk. Build on lessons learned from acid gas injection projects.

- Through demonstration projects in Alberta and elsewhere (e.g. Weyburn, Sask.) resolve any outstanding and new health, environmental and safety issues dealing with capture, transportation and storage.
- Establish a CO_2 monitoring component on storage and leakage associated with three existing commercial demonstration projects.

Consult with Public to Increase Awareness, Understanding and Acceptance

- Help achieve greater public awareness and understanding by addressing public concerns on safety, and environmental issues associated with CO_2 storage.

Energy conservation

Vision

Albertans are North American leaders in the smart use of energy.

Energy conservation and improved energy efficiency are key means by which Albertans can begin breaking the link between economic prosperity and emissions growth.

Over the past several years, Alberta organizations (industry, small businesses, municipalities) and the Alberta public have increased their energy efficiency through a range of cost-effective actions. Equipment, materials, and technologies are continuing to evolve and increased efficiencies remain viable.

Achieving these efficiencies will require a renewed commitment from all Albertans.

The Alberta government will work in partnership with other Alberta organizations and in dialogue with stakeholders to facilitate further action on energy conservation.

Achieving greenhouse gas emissions reductions within the building and transportation sectors will require a broad mix of initiatives, including incentives for energy efficient investments and minimum energy efficiency expectations.

Additionally, it may be possible to redesign existing infrastructure programs with municipalities to encourage more efficient forms of infrastructure development. For example, to what extent can funds be earmarked towards municipal energy efficient investments or alternatives to new infrastructure (e.g. promotion of telecommuting)?

What do we mean when we say energy conservation?

This strategy takes a very broad definition of energy conservation.

In addition to actions aimed at reducing the consumption of energy, this strategy also includes initiatives aimed at energy efficiency - or making our energy use more productive - and actions that support alternative energy sources (e.g. renewable power, small turbines, district energy, etc.).

Whether it is through energy conservation, energy efficiency, or the use of alternative energy sources, it is possible to use our energy supplies more effectively and to ensure more sustainable supplies of all forms of energy are available to all Albertans.

Energy conservation initiatives are essentially aimed at changing patterns of energy use.

These initiatives will ultimately allow Albertans and Alberta organizations to be more efficient with the energy that they consume.

The Alberta government's approach to energy conservation will focus on the following four elements:

- Facilitating access to electricity generated from a diversity of energy sources and energy conservation alternatives.
- Demonstrating leadership and reducing operating costs by promoting and implementing energy efficient options for government operations (*see above section*).
- Creating awareness and choices for the adoption of energy conservation opportunities by Albertans.
- Encouraging innovation through demonstration or by encouraging action.

Specifics include:

ACTION:

Facilitate access to electricity generated from a diversity of energy sources and energy conservation alternatives.

- Assess opportunities to enhance market signals for low impact generation.
- Continue to reduce regulatory barriers for low impact electrical generation.
- Pursue options for load shifting.
- Examine roles of different players in the market (e.g. generators, distribution companies, retailers, energy performance contractors) and identify opportunities for pursuing energy efficiency improvements.
- Identify barriers to the broader adoption of new approaches to energy use - especially distributed generation and district heating.

ACTION:

Demonstrate leadership and reduce operating costs by promoting and implementing energy efficient options for government operations.

- Continue to improve government efficiency through the Voluntary Challenge and Registry Action Plan.
- Communicate energy conservation opportunities to government staff.
- Work with education and health sectors to identify opportunities for a cooperative approach to energy efficient retrofits.
- Integrate increased energy efficiency into management decisions within government and promote adoption of sustainable business practices.
- Finalize an energy retrofit program for government-owned buildings.
- Enter into agreements with Alberta cities on the development and implementation of community action plans on climate change and greenhouse gas emission reduction.

ACTION:

Create awareness and choices for the adoption of energy conservation opportunities by Albertans.

- Establish a new Energy Efficiency Office within Climate Change Central to act as a focus point for Albertans looking for assistance in pursuing energy efficiency opportunities and to disseminate educational tools.
- Intensify efforts to help Albertans demonstrate environmental stewardship (including energy efficiency) through school-based programs and public education.
- Expand public communications programs targeting energy efficiency.
- Promote and augment existing national energy conservation initiatives.
- Develop publicly accessible information tools that enhance private sector energy efficiency services.
- Link information and promotional programs with instruments and tools to promote action.

ACTION:

Encourage innovation through demonstration or by encouraging action.

- Establish market-based mechanisms for facilitating urban lighting retrofits.
- Work with municipal, education, health and commercial sectors to identify opportunities for a cooperative approach to energy efficiency retrofits (e.g. aggregation of energy savings opportunities).
- Facilitate establishment of district heating systems, where practical and cost effective.
- Partner with Climate Change Central and others to establish mechanisms for reducing the up-front capital costs of retrofits, new appliances or distributed energy sources.
- Engage industry sectors in the identification of stewardship opportunities.
- Work through Alberta Energy Research Institute to support research aimed at energy efficiency and alternative energy technologies.
- Work in partnership with the building construction sector to increase the efficiency of new buildings.
- Establish a task force to consult with stakeholders and consumer groups to explore economic incentives for energy conservation and identify potential revenue sources.
- Partner with municipalities to ensure existing infrastructure programs encourage more efficient forms of development.

Storing Carbon in Agricultural and Forestry Sinks

Vision

To develop, enhance and promote environmentally sustainable agriculture and forestry practices across Alberta that make meaningful longer-term contributions to reducing atmospheric greenhouse gas concentrations.

Alberta has significant potential for sequestering carbon through our agricultural and forestry sinks.

Alberta stakeholders have been active in understanding the magnitude of this potential and taking action to enhance carbon storage in soils and forests. For example, early indications are that with significant adoption of environmentally sustainable management practices, agriculture can potentially contribute significantly to offsetting greenhouse gas emissions within Alberta.

Within the province, we are moving to ensure this potential is realized. For example, no-till and low-till farming practices are increasingly becoming recognized as good farming management practices. Some forest producers are exploring ways of enhancing the carbon uptake from managed forests.

The benefits of today's environmentally sustainable management practices to both the environment and agriculture/forestry sectors justify programming and policies directed towards adopting these practices.

This approach can be achieved by using currently available best management practices including reduced or zero till farming, comprehensive nutrient management, reduced summer fallow and bioenergy sources.

This could also be applied in a forestry context, where best management practices for silviculture can result in a timely benefit to global well-being by increasing stored carbon both in forest soils and trees.

The overall strategy for forest management in Alberta is to ensure that the values and benefits Albertans receive today from wildlife resources and economic, recreational, cultural and social activities conducted on Alberta's public lands are sustainable for future generations.

The storage of carbon in forestry ecosystems is currently an economic benefit to Alberta that, through proper sustainable management of the forest, can remain a benefit for years to come.

Alberta will continue to explore sustainable forest management options that would maintain or increase carbon storage, reduce emissions, or may reduce the risk of emissions.

Most stakeholders agree that agriculture and forestry sinks can provide a short term, cost-effective solution for major greenhouse gas emitters to meet anticipated regulatory requirements for greenhouse gas emission reductions. However, there is currently reluctance to engage in emissions credit trading until a regulatory framework establishes the rules for a trading system.

Rules for monitoring, measurement and verification (MMV), registration and tracking projects need to be in place.

Within Alberta, Climate Change Central is pulling stakeholders together to explore opportunities for enhancing carbon sequestration activities in the agriculture and forest sectors, and to develop systems for measuring and verifying the emission reductions associated with these activities.

Many organizations, including industry, are increasingly looking at emission reductions from carbon sequestration as an element of their overall greenhouse gas plans. Carbon sequestration is an important activity to help ease the transition until low-emitting technologies enter the market.

In conjunction with the development of an emissions trading system (*see above*), the Alberta government seeks to ensure that emission reductions achieved through verifiable carbon sequestration initiatives can be used against corporate or sectoral objectives.

Agriculture and forestry stakeholders need clear policy direction on:

- Ownership of carbon in the soil and vegetation (and this applies primarily to emission removals).
- Whether the agriculture or forestry sector is regulated in the future.
- Whether there will be credit for early action.

Carbon sequestration in agriculture and forest sinks is a reversible process, and this reversal can happen within a very short period of time. The core concern associated with the impermanent nature of carbon sinks is who bears the ultimate liability for released carbon - if credit is given when carbon is sequestered, who gets the debit when carbon is released?

In order to move forward on sink opportunities, the liability issue needs to be resolved.

To realize Alberta's biological sink opportunities, the following focus areas will be pursued:

ACTION:

Explore the use of biological sinks (agriculture soils and forestry) in Alberta as part of the Alberta strategy for addressing climate change.

- Conduct and compile cost/benefit analyses of best management practices in agriculture and forestry to demonstrate their improved efficiency and conservation benefits.
- Develop a science plan, identifying the gaps and uncertainties in our current greenhouse gas removal/reduction estimates, to ensure that appropriate research is identified.
- Explore the feasibility of establishing a provincial multi-sector fund that offers conservation incentives for desirable environmentally sustainable agriculture/forestry practices.
- Examine potential market-based instruments for adoption of these practices, such as tradable permits (land use, GHG emissions), tax credits, financial incentives, etc.

- Assess the use of the environmental farm plan as a delivery mechanism for best management practices.
- Assess incentives to adopting conservation practices (i.e. crop insurance schemes, etc.).

ACTION:

Address stakeholder uncertainty.

- Develop a policy statement on ownership of the carbon in the soil:
    - The ownership of carbon through forest management activities carried out by timber companies on private lands would be owned and managed by the timber company; however, if the landowner/manager made significant investments of time, labour and capital, then a revenue-sharing approach may be necessary.
    - The carbon credits from provincial Crown land that may result from Canada deciding to include forest management as part of the Kyoto Protocol should be used to offset Alberta's greenhouse gas emissions. This would mean that the credits should be traded within Alberta.

ACTION:

Establish a provincial GHG emissions trading framework.

- Develop specific criteria for application of sink credits to current offset obligations for new thermal power plants.
- Establish the framework for a measuring, monitoring and verification system.
- Advance understanding through pilots and continuous research, in partnership with other stakeholders.
- Undertake a full cost analysis of greenhouse gas reducing practices, including monitoring and verifying reductions.
- Establish a 1990 soil carbon/forestry level baseline to recognize and not penalize early adopters.
- Develop a land use registry for documenting greenhouse gas emissions reductions and removals (where sound science-based emission coefficients can be linked at a later date).

ACTION:

Overcome permanence and liability issues.

- Examine an appropriate mechanism for dealing with liability in emissions removal.
- Couple this mechanism with standard contracts for facilitating trades and minimizing risks between buyer and seller.
- Identify the magnitude of the risk - assess the risk/cost of a range of emissions from previously sequestered soil carbon.
- Develop specific criteria for application of sinks credits to current offset obligations for new thermal power plants.

Vision

Albertans, their communities and industries take steps to prepare for possible future climates and develop the ability to adapt successfully to changes in climate.

While it is important to reduce greenhouse gas emissions in an effort to mitigate climate change, we must also adapt to climate change for Alberta's well-being and to maintain economic prosperity.

Adaptation is necessary irrespective of the causes of climate change - it seeks to ensure that our natural and socio-economic systems are able to cope with the potential impacts of climate change and can take advantage of potential opportunities.

It must begin from where climate effects are felt, addressing the particular changes experienced there. Alberta requires its own adaptation strategy geared towards our specific needs, yet building on what is transferable from elsewhere.

Adaptation is risk management based on sound science.

Risk management for climate change is based on anticipating, understanding and addressing the effects of climate change. Scenarios of emissions, climate and socio-economic conditions are used to provide estimates of potential impacts. Scenarios are not forecasts or predictions - they describe plausible futures. A range of scenarios is needed to assess the risk. Therefore decision-making must be based on sound science and objectivity to ensure Albertans are well-informed about the options available.

Research and development, monitoring and communications are important to ensure good information is available to everyone affected by climate change.

Climate change affects our society, environment and economy. However, different systems have different natural and socio-economic characteristics, so adaptation to climate change will differ among systems.

An Alberta climate change adaptation strategy must involve cooperative efforts between the sectors affected by climate change. This cooperation will also improve overall priority setting and help ensure the objectives of different government departments complement each other and are responsive to changing needs. Cooperation is also necessary to assess and monitor progress when dealing with the long-term adaptation process.

ACTION:

Establish an adaptation research program including collaboration with other governments in Canada.

- Establish partnerships with federal-provincial research agencies, such as the Prairie Adaptation Research Collaborative (PARC), for collaboration in research on prairie adaptation.
- Support the University of Lethbridge's sustainable water initiative that includes a significant climate change adaptation component.
- Identify information gaps and coordinate research in the science, impacts and adaptation of climate change, focusing on Alberta.

- Develop synergy and partnership with other climate change research and development efforts such as BIOCAP Canada Foundation, a national university research organization for biology-based research in climate change.
- Provide a basic set of climate scenarios for use by government departments and all Albertans.
- Develop suitable indicators and information systems so that significant changes can be detected.
- Determine analytical and data requirements for key sectors affected by climate change.

ACTION:

Help Albertans explicitly address the risks of short-term climate variability and extremes - notably in the management and planning for agriculture, forestry, health, municipalities, infrastructure and water.

- Assess the impacts associated with current and future climate extremes.
- Explicitly assess current responses to climate extremes.
- Incorporate improved responses to climate extremes explicitly into management and planning.

ACTION:

By 2010, prepare Albertans to deal with longer-term climate changes as a result of developing scenarios; assess the ability of our natural systems, economy and institutions to adapt; develop options, make investments and implement appropriate changes.

- Assess the ability of our major systems (natural, economic and institutional) to adapt to the range of possible future climates.
- Develop options to increase adaptability of those systems that are not sufficiently robust.
- Implement changes to management systems to ensure that they have the ability to address possible future climates.

ACTION:

Keep Albertans informed of the risks and opportunities of climate change and engage them in adaptation efforts.

- Inform Albertans of what the government is doing on adaptation to climate change.
- Involve Albertans in adaptation through their daily activities.
- Facilitate access to current knowledge of climate change and adaptation.

Applying Alberta's Plan Nationally

All jurisdictions in Canada recognize the need to act on climate change, but it is proving difficult to find an approach that:

- Respects all of the principles set out by First Ministers and most provincial and territorial Energy and Environment Ministers, as set out in a recent letter to the Prime Minister.
- Honours the Prime Minister's commitment that "no province or region will be asked to bear an unreasonable share of the burden."
- Protects the competitiveness concerns of industry.

The current national analysis fails to address the longer-term need to reduce emissions intensity and thereby achieve the longer-term gain of positioning all of our economies to be competitive in a GHG-constrained future.

The Alberta government contends that the general approach taken in Alberta's *Plan for Action* might point the way to a new national framework, built around a "made-in-Canada" approach, that allows us all to move forward in acting on climate change.

Alberta's proposed approach strives to:

- Allow for immediate reductions in greenhouse gas emissions rather than waiting until 2008.
- Encourage the technological change and change in capital stock and behaviour that is required to make a difference on climate change.
- Achieve reductions in Canadian greenhouse gas emissions at reasonable levels while avoiding the deadweight costs associated with having to purchase international greenhouse gas credits.
- Provide industry, stakeholders and the public with real choices as to how they see emission reductions most effectively occurring.
- Establish a strong role for provinces and territories to self-select goals, burdens and commitments that they can meet and that they can afford to meet.

Overall, *Albertans & Climate Change: A Plan for Action* outlines positions, approaches and opportunities to make a real difference in managing the environmental and economic impacts of climate change.

This action plan can serve as the basis for an effective, collaborative, equitable national approach to climate change, which respects the goals and values of Albertans - enjoying prosperity and opportunity in an enhanced Alberta environment, while contributing responsibly to solve global issues.

Next Steps

The Government of Alberta strongly believes responding to the climate change challenge will require the expertise, innovation and insights of all Albertans. Governments cannot do it alone.

The draft Plan for Action outlines the Alberta government's thinking on a practical and effective approach to managing the risks of climate change while maintaining the province's economic prosperity, and provides a basis from which the Alberta government will consult with key stakeholders groups and the public.

Over the spring and summer of 2002, the Alberta government will meet with a broad range of stakeholder organizations to consult on this draft plan.

The Alberta government will also look for stakeholder support in shaping key elements of the plan and in championing key initiatives within its key focus areas.

Advancing this action plan on climate change is based on solid partnerships between governments and stakeholders, specifically, the Alberta government will seek input on the following areas:

- Is a carbon intensity-based target an effective way for advancing action on climate change in a manner that is integrated with economic prosperity?
- Is the level of reduction reasonable given Alberta's economic trends?
- Should the Alberta government pursue partnership agreements with key sectors?
- How can these agreements be developed to ensure results are achieved in a least-cost manner?
- Should Alberta move ahead with its own emissions trading system?
- How can Alberta most effectively support investment in new technologies related to greenhouse gas emission reduction and carbon capture and storage?
- What types of energy conservation actions make the most sense for Alberta?
- Is there support for identifying a dedicated revenue source for climate change and energy efficiency investments?

The Alberta government will incorporate public and stakeholder feedback into this action plan, to be finalized by December 2002.

A Glossary of Terms

Carbon Sinks

Any naturally occurring thing, like forests or specific kinds of agricultural activity, that can be grown or created specifically to help absorb more carbon dioxide.

Cleaner Energy Exports

Natural gas or hydropower from Canada provides an environmental benefit to the United States when they buy and use these "cleaner" fuels in place of their coal-fired electric power. However, producing this cleaner energy generates greenhouse gas emissions in Canada, for which we would be liable under any international emissions reduction agreement like Kyoto. The federal government is now arguing that Canada's cleaner energy exports should be recognized internationally.

Climate Change

The Earth's climate system adjusts to any rise in greenhouse gas levels to keep its global "energy budget" in balance. A thicker blanket of greenhouse gases - from increased human burning of fossil fuels for example - will result in warming of the Earth's surface and its lower atmosphere, or in changed climate patterns.

Climate Change Central

A unique public-private partnership that promotes the development of innovative responses to global climate change and its impacts. The Alberta government is a partner in Climate Change Central's efforts to build links and relationships between businesses, governments and other stakeholders in Alberta interested in pursuing greenhouse gas reduction initiatives.

Domestic Emissions Trading

Emissions trading within Canada, as distinct from international emissions trading.

Emissions Intensity

Greenhouse gas emissions released as measured against some other factor like the Gross Domestic Product (GDP) of a nation, province or state. Other standards by which emissions intensity can be measured include: per barrel of oil; per million cubic feet of natural gas; per tonne of coal, cement, etc. produced; or per megawatt hour of electricity.

Emissions Trading

A market-based system that allows companies flexibility to choose the most cost-effective solutions to achieve established environmental goals. Companies that produce fewer emissions than they are allowed could sell their "excess capacity" to others who do not.

Greenhouse Gases (GHGs)

The main greenhouse gases are water vapour, carbon dioxide, ozone, methane, nitrous oxide and the chlorofluorocarbons (CFCs). All but CFCs occur naturally. Collectively, these gases make up less than one per cent of our atmosphere, sustaining what is called the Earth's "natural greenhouse effect." Without this, Earth would be 30 degrees cooler - essentially, a frozen planet.

International Credits/Permits

The Kyoto Protocol allows for creation and transfer of emissions credits or permits between countries. These are designed to minimize the cost of reducing global greenhouse emissions and include: Joint Implementation (emission-reducing projects between two countries with a Kyoto target); Clean Development Mechanisms (project-based reductions between developed and developing countries), and International Emissions Trading (international trading of international greenhouse gas permits).

Intergovernmental Panel on Climate Change (IPCC)

A panel set up by the World Meteorological Organization and the United Nations Environment Programme in 1988, in recognition of potential global climate change. The panel's role is to assess the scientific, technical and socio-economic information needed to understand the risk of human-induced climate change. IPCC does not carry out research or monitor climate related data, but bases its assessments mainly on peer reviewed and published scientific/technical literature.

Kyoto Protocol

Adopted in 1997, Kyoto's key concepts state that: developed countries should commit to reducing collective emissions of six key greenhouse gases by an average of at least five per cent; national emissions targets must be achieved by 2008-2012; and, countries have some flexibility in how to make and measure their emissions reductions.

Non-Renewable Energy

Non-renewable energy comes from a resource that is not replaced, or replaced only very slowly, by natural processes. Primary examples of fossil fuels are: oil, natural gas and coal. These fossil fuels are produced by decay of plant and animal matter, at much slower rates than our present fossil fuel consumption.

Renewable Energy

An energy resource that is replaced rapidly by natural processes. Examples include: sunlight, hydropower (water a through a dam) and wood.

Tradeable Emissions Permits

Part of a domestic emissions trading system *(see above)* that allows an emitter a specified number of tonnes of emissions. Once this limit has been reached, the permit expires. Total number of permits in any tradable market equals the level of emissions sought by the regulating authorities.

U.N. Framework Convention on Climate Change

This is the governing body for international climate change negotiations that was established in 1992 at the Rio Earth Summit. The convention's primary objective is: "stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic (man-made) interference with the climate system." This level is to be achieved "within a time-frame sufficient to allow ecosystems to adapt naturally to climate change, to ensure that food production is not threatened, and to enable economic development to proceed in a sustainable manner." The Kyoto Protocol document came out of this U.N. convention.

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